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# Biodiversity of melliferous plants of the Surkhandarya region and assessment of their use

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**Abstract:** A detailed study of the species composition, nectar productivity and honey productivity of the wild-growing melliferous flora of the Surkhandarya region of Uzbekistan has been carried out. It was found that the majority of melliferous species grow in the adyr zone - 231 species and in mountainous areas - 280 species. The melliferous plants of the studied region are secondary melliferous plants, thus providing additional takings and contributing to the development of bee colonies. New melliferous plant species with a high sugar content in nectar (from 1.4 to 243 mg in 100 flowers) have been identified. Species of the genus *Onosma* were found to be highly nectariferous. The average amount of nectar secreted by 100 flowers of plants of this genus ranges from 100 to 243 mg.

## 1. Introduction

The sustainable development of agriculture in modern conditions is based on the widespread use of the biological and ecological potential of plants [1, 2]. The most important role in the implementation of this task is played by the study and development of plant resources, including wild flora. There are 4500 species of higher plants in Uzbekistan [3]. Honey plants, which are part of the resources of Uzbekistan, are a fodder base for the widespread development of beekeeping.

Beekeeping, as a branch of agriculture, occupies a certain place in the economy of the national economy of many countries [4, 5, 6, 7, 8]. Beekeeping can be called a key area of agriculture in Uzbekistan. Currently, there are 450,500 thousand bee families in the republic, and the average yield of marketable honey is 21,410 tons. There is 0.700 kg of honey per capita in the country.

The wild-growing composition of the flora is changing, since the development of the territory for agricultural crops, the use of the collection of medicinal and forage plants, the destruction of weeds in the fields lead to a decrease in the area occupied by wild melliferous plants.

Many researchers have studied the melliferous flora of Uzbekistan. However, these materials are outdated and do not meet the requirements of modern science and practice.

## 2. The objective of study

The objective of study was to identify the modern species composition, to study the geographical and ecological features of the distribution of melliferous plants in the territory of the Surkhandarya region



of the south of Uzbekistan, to determine the amount of nectar and the sugar content in it in melliferous plants.

The peculiar climate and duration of the growing season of plants create all the conditions for the successful development of apiculture in the Surkhandarya region. The lower and middle parts of the mountains are especially rich in melliferous species, such as *Perovskia scrophularifolia*, *Amygdalus bucharica*, *Amygdalus spinosissima*, *Cerasus verrucosa*, *Althaea nudiflora*, *Psorale adrupacea*, *Salvia virgata*, *Salvia deserta*, *Salvia sclarea*, *Salvia spinosa*, *Capparis spinosa*, *Alhagi pseudoalhagi*, *Melilotus officinales*, *Nigella integrifolia*, *Nigella bucharica*, *Ziziphora tenuior*, *Ziziphora pedisellata*. In spring, starting from April and in summer, honey plants are used in nomadic beekeeping.

### 3. Research methodology

The accounting of the melliferous flora species composition was carried out by means of geobotanical descriptions of the encountered plant species according to the method developed by a team of specialists from the Institute of Botany named after V.L. Komarov [3], plant species were determined according to the book "Flora of Uzbekistan" and the identifier of plants in Central Asia [3, 9]. The determination of the amount of nectar was carried out by the microcapillary method. The nectar of plants with open nectaries was extracted by rinsing [10]. The amount of nectar was determined on a TV-500 torsion balance, the sugar content in the nectar was determined with an RL-3 refractometer.

### 4. Research results

We divided the biodiversity of melliferous plants in the Surkhandarya region and the degree of their nectar productivity into primary melliferous plants, abundantly secreting nectar, actively visited by honey bees and providing marketable products, and secondary ones, giving supporting taking, and also identified new melliferous plants.

On the plains, foothills and mountains of the region, there is a large number of plant species, which are visited by honey bees and other entomophilous insects to collect nectar and pollen. These are honey plants and perganots. We calculated the number of families that include melliferous plants, as well as the number of genera and species in them (tables 1 and 2). It turned out that the wild-growing melliferous flora of the Surkhandarya region is composed of 59 families, 270 genera and 668 species, which is about 60% of the total number of species growing in the region.

In terms of the number of genera, the first place is taken by the Asteraceae family - 35 genera, the second by the Lamiaceae - 25, Fabaceae - 23, Rosaceae and Apiaceae - 22 genera, and the third by the Brassicaceae - 17 genera.

Seven families have the highest species richness: Asteraceae - 93 species, Fabaceae - 71, Rosaceae - 67, Lamiaceae - 53, Liliaceae - 50, Apiaceae - 49 and Brassicaceae - 35 species. They cover more than half (69.3%) of the total composition of honey plants.

The families Amaryllidaceae, Orchidaceae, Portulacaceae, Juglandaceae, Frankenaceae, Violaceae, Lythraceae, Oleaceae, Ebenaceae, Oxalidaceae have one species each.

The part of such families as Anacardiaceae, Balsaminaceae, Vitaceae, Gutteferae, Rubiaceae, Campanulaceae, Apocynaceae, Resedaceae, Poaceae, Capparidaceae, Linaceae, Elaeagnaceae, Solanaceae, Plantaginaceae, Euphorceulaceae, Aceraceae, Genaceae, Zygophullaceae, Rhamnaceae, Tamaricaceae, Onagraceae contains two to five types of honey plants.

The families Convolvulaceae, Cuscutaceae, Dipsacaceae, Iridaceae, Geraniaceae, Malvaceae, Papaveraceae, Caryophyllaceae, Salicaceae, Scrophylariaceae, Polygonaceae have six to fourteen species.

In the flora of the Surkhandarya region, the life forms of the above melliferous plants are distributed as follows: trees - 36 species (5.3%), shrubs and semi-shrubs 99 species (14.8%), herbs 533 (79.7%).

It should be noted that the absolute majority (80.5%) of the identified honey plants (487 species) provide bees with both nectar and pollen. The number of species providing bees only with pollen is insignificant - 52 species (8.6%), nectar 66 species (10.9%).

**Table 1.** Floristic composition and life forms of melliferous plants of Surkhandarya region.

## Part (a)

Families	Quantity		Life forms		
	genus	species	trees	shrubs	herbs
Poaceae	2	3	-	-	3
Liliaceae	8	50	-	-	50
Amaryllidaceae	1	1	-	-	1
Iridaceae	4	7	-	-	7
Orchidaceae	1	1	-	-	1
Polygonaceae	4	14	-	8	6
Portulacaceae	1	1	-	-	1
Caryophyllaceae	3	7	-	-	7
Salicaceae	2	10	9	1	-
Juglandaceae	1	1	1	-	-
Ranunculaceae	10	26	-	-	26
Berberidaceae	4	5	-	2	3
Papaveraceae	4	9	-	-	9
Capparidaceae	2	3	-	-	3
Brassicaceae	17	35	-	-	35
Resedaceae	1	2	-	-	2
Crassulaceae	4	6	-	-	6
Saxifragaceae	3	5	-	2	3
Rosaceae	22	67	14	38	15
Fabaceae	23	71	1	12	58
Geraniaceae	3	7	-	-	7
Linaceae	1	3	-	-	3
Oxalidaceae	1	1	-	-	1
Zygophyllaceae	3	5	-	1	4
Rutaceae	2	6	-	1	5
Euphorbiaceae	2	4	-	-	4
Anacardiaceae	2	2	2	-	-
Aceraceae	1	4	4	-	-
Balsaminaceae	1	2	-	-	2
Rhamnaceae	3	5	1	4	-
Vitaceae	2	2	-	2	-
Malvaceae	2	7	-	-	7
Guttiferae	1	2	-	-	2
Frankenaceae	1	1	-	1	-
Tamaricaceae	1	5	-	5	-
Violaceae	1	1	-	-	1
Elaeagnaceae	2	3	2	1	-
Lythraceae	1	1	-	-	1
Onagraceae	1	5	-	-	5
Apiaceae	22	49	-	-	49
Primulaceae	3	4	-	-	4
Plumbaginaceae	2	4	-	-	4
Oleaceae	1	1	1	-	-
Ebenaceae	1	1	1	-	-
Gentianaceae	2	4	-	1	3
Apocynaceae	2	2	-	-	2
Convolvulaceae	2	6	-	1	5
Cuscutaceae	1	6	-	-	6
Boraginaceae	8	19	-	-	19

## Part (b)

Families	Quantity		trees	Life forms	
	genus	species		shrubs	herbs
Verbenaceae	2	2	-	1	1
Lamiaceae	25	53	-	11	42
Scrophylariaceae	6	14	-	-	14
Solanaceae	1	3	-	3	-
Plantaginaceae	1	3	-	-	3
Rubiaceae	2	2	-	-	2
Caprifolidaceae	1	4	-	4	-
Dipsacaceae	3	6	-	-	6
Campanulaceae	2	2	-	-	2
Asteraceae	35	93	-	-	93
Total	270	668	36	99	533

**Table 2.** The numerical ratio of melliferous plants of the main families of the Surkhandarya region.

Families	Quantity		Percentage of total
	genera	species	
Asteraceae	35	93	13.9
Fabaceae	23	71	10.6
Rosaceae	20	64	9.5
Lamiaceae	25	53	7.9
Liliaceae	8	50	7.5
Apiaceae	22	49	7.3
Brassicaceae	17	35	5.2
<b>Total</b>	<b>150</b>	<b>415</b>	<b>62.1</b>

Of the total number of honey plants, about 100 species are widespread and form thickets. The rest of the species are found in small spots or groups. The richest in melliferous plants are the adyr (231 species) and tau (280 species) zones.

Most of the melliferous plants growing in the Surkhandarya region are secondary. They provide additional taking and contribute to the development of bee colonies.

The pollen flow in the study area is mainly provided by primary melliferous plants. Along with them, important pollen plants are *Papaverpavoninum*, *Roemeriarefracta* and *Plantagolanceolata*; species of the genera *Tulipa*, *Gagea*, *Rumex*, *Ranunculus*, *Rosa*, etc.

It should be emphasized that plant pollen is a valuable protein feed for bee brood. The annual demand of bee colonies for pollen is about 15-17 kg. In this regard, it is very important that there are plants around the apiary that provide abundant pollen to the bees. The aforementioned pollen plants can be recommended to beekeepers.

Among the primary melliferous vegetation widespread in the Surkhandarya region, we have identified the following:

Trees and shrubs (honey productivity of conditionally clean plantations is 20-100 kg/ha): rounded bladderwort, mesh maikaragan; Bukhara and prickly almonds; gray blackberry; common plum; Regel's pear; Siversov's apple tree; hawthorn Turkestan, Pontic, Hissar; cherry magaleb, red-fruited and warty; grape-leaved vine; double leaf of Goncharov; cystic cotoneaster; barberry is oblong and whole-edged.

Herbs (honey productivity from 40 to 250 kg/ha): medicinal sweet clover; thin-leaved vetch; ferula Yeshke; yantak grayish, false and Persian; ankhuza italian; gigantic large carp; Desert grate Lehmann and Baysun; alternate-toothed shandra; drupe psoralei; yellow mignonette; the sainfoin is large and beautiful; astragalus maveranagr; kattran Kochi; cousinia resinous, Spygina and ray; small-flowered

oregano; prangos stern; mimosa performed; Italian bruise; ziziphora is short-cheeky; Zeravshan hyssop; fenugreek Popov, Pamir and Zapryagaev; prickly capers: motherwort Turkestan; rod-shaped sage; Asian mint; naked licorice.

Cultivated honey plants and sown for bees (honey productivity from 50 to 200 kg/ha): cotton, alfalfa, rapeseed, white acacia, indau, oil flax, castor oil plant, cabbage, high ailant, pink marshmallow, annual sunflower.

When studying the composition of melliferous plants, we identified plants with a wide range, actively visited by entomophilous insects to collect nectar and pollen, but not indicated in the literature as melliferous plants. Such plants belonging to different life forms, 40 species have been identified. Among them: trees - 2 species, shrubs and semi-shrubs - 8, herbaceous -30 species. The above species belong to 10 families and 26 genera, 37 of them are nectariferous and pollen-bearing.

Of the identified melliferous plants, the most interesting are: *Trigonellalipskyi*, *Trigonellaadscendens*, *Trifoliumlappaceum*, *Astragalusspryginii*, *Astragalusmaverranagri*, *Onobrychisschugnanica*, *Zygophyllumgontscharovii*, *Althaealudwigii*, *Solidagokuhistanica*, *Lindelofiaolgae*, *Solenanthuscoronatus*, *Inulaglauca*.

The average amount of sugar in the nectar of 100 flowers in these melliferous plants ranges from 1.4 to 243 mg. Species of the genus *Onosma* turned out to be very highly nectariferous. The average amount of nectar secreted by 100 flowers of plants of this genus ranges from 100 to 243 mg.

Most of the new melliferous plants are from the families Fabaceae (6 genera, 9 species), Boraginaceae (3 genera, 9 species), Rosaceae and Asteraceae (3 genera and 6 species each), Lamiaceae (3 genera, 3 species).

The average amount of sugar in the nectar of 100 flowers in the main melliferous plants ranges from 1.4 to 243 mg. The average amount of nectar secreted by 100 flowers of plants of *Onosma* genus ranges from 100 to 243 mg.

All the honey plants that we have described can be used as a supporting taking, and in combination with other melliferous vegetation, they can serve as sources of honey collection.

## 5. Conclusions

A detailed study of the melliferous plants of the plant flora of the Surkhandarya region showed that their plant groups sharply differ in floristic composition and honey productivity.

Wild-growing melliferous flora is widespread in all three high-altitude fields: chul, adyr and mountain zones of the region. 231 species and 280 species of mountains were especially rich in melliferous species of the adyr zone. Of these, about 100 identified species form thickets and are edificators and dominants of plant communities.

The pollen-bearing flora is based on *Papaverpavoninum*, *Roemeriarefracta*, *Plantagolanceolata*, *Plantagomajor*, *Poteriumpolygamum*, *Scillavvedenskyi*, *Crocuskorolkovii*, *Junobucharica*, *Glauciumfibrilligiarum*, species of the genera *Tulipa*, *Allanosa*, *Rumex*, *Ranunculus*, *Rosa*, *Achillea*, *Iris*.

The average amount of sugar in the nectar of 100 flowers in the main melliferous plants ranges from 1.4 to 243 mg. The average amount of nectar secreted by 100 flowers of plants of *Onosma* genus ranges from 100 to 243 mg.

The new melliferous plants that we identified in the Surkhandarya region broaden the understanding of the melliferous flora of this region and, we think, will attract the attention of researchers and beekeepers.

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